

**WHAT IS CLAIMED IS:**

1           1. A method of determining a remaining operating  
2     time of a potentiometric measuring probe containing an  
3     electrolyte, wherein a primary reference element and a  
4     secondary reference element are arranged so that an  
5     electrolyte deficiency advancing from an opening of the  
6     measuring probe arrives at the secondary reference element  
7     before it arrives at the primary reference element, the  
8     method comprising the steps of:  
9     - monitoring a potential difference ( $V_{12}$ ) existing between  
10    respective electrical potentials of the primary reference  
11    element and the secondary reference element for  
12    conformance to a predefined tolerance criterion;  
13    - when the tolerance criterion is found to be violated,  
14    determining the elapsed operating time from when the  
15    measuring probe was put into operation and retaining said  
16    elapsed operating time as a base time period ( $t_g$ );  
17    - calculating a remaining operating time ( $\Delta t_r$ ) of the  
18    measuring probe from the base time period ( $t_g$ ).

1           2. The method according to claim 1, wherein a  
2     violation of the tolerance criterion causes a warning signal  
3     to be triggered.

1           3. The method according to claim 1, wherein the

2 monitoring of the potential difference ( $V_{12}$ ) is substantially  
3 continuous.

1 4. The method according to claim 1, wherein the  
2 monitoring of the potential difference ( $V_{12}$ ) is performed at  
3 intermittent points in time.

1 5. The method according to claim 1, wherein signal-  
2 filtering is used in the monitoring of the potential  
3 difference ( $V_{12}$ ).

1 6. The method according to claim 1, wherein a  
2 departure of the absolute amount ( $|V_{12}|$ ) of the potential  
3 difference from a predefined tolerance range is used as a  
4 condition for finding the tolerance criterion violated.

1 7. The method according to claim 1, wherein a  
2 traverse of one or more predefined tolerance values by the  
3 absolute amount ( $|V_{12}'|$ ) of the first time derivative of the  
4 potential difference is used as a condition for finding the  
5 tolerance criterion violated.

1 8. The method according to claim 1, wherein a  
2 traverse of one or more predefined tolerance values by the  
3 absolute amount ( $|V_{12}''|$ ) of the second time derivative of the  
4 potential difference is used as a condition for finding the

5 tolerance criterion violated.

1           9. The method according to claim 1, wherein the  
2 remaining operating time ( $\Delta t_R$ ) is calculated by multiplying  
3 the base time period ( $t_G$ ) with a predefined multiplication  
4 factor ( $m$ ).

1           10. The method according to claim 1, wherein after  
2 a violation of the tolerance criterion has occurred, the  
3 potential difference ( $V_{12}$ ) is monitored for conformance to a  
4 predefined alarm criterion; and when the alarm criterion is  
5 found to be violated, the remaining operating time ( $\Delta t_R$ ) is  
6 set to zero.

1           11. The method according to claim 10, wherein a  
2 violation of the alarm criterion causes an alarm signal to  
3 be triggered.

1           12. The method according to claim 10, wherein a  
2 departure of the absolute amount ( $|V_{12}|$ ) of the potential  
3 difference from a predefined alarm range is used as a  
4 condition for finding the alarm criterion violated.

1           13. The method according to claim 10, wherein a  
2 traverse of one or more predefined alarm values by the  
3 absolute amount ( $|V_{12}'|$ ) of the first time derivative of the

4 potential difference is used as a condition for finding the  
5 alarm criterion violated.

1 14. The method according to claim 10, wherein a  
2 traverse of one or more predefined alarm values by the  
3 absolute amount ( $|V_{12}''|$ ) of the second time derivative of the  
4 potential difference is used as a condition for finding the  
5 alarm criterion violated.

1 15. Apparatus for performing the method of  
2 claim 1, comprising:

- 3 a) a potentiometric measuring probe with an electrolyte and  
4 with a primary reference element and a secondary  
5 reference element that are arranged so that an  
6 electrolyte deficiency advancing from an opening of the  
7 measuring probe arrives at the secondary reference  
8 element before it arrives at the primary reference  
9 element;
- 10 b) time-measurement means for measuring the elapsed  
11 operating time ( $t$ ) from when the measuring probe was put  
12 into operation;
- 13 c) monitoring means for monitoring the potential difference  
14 ( $V_{12}$ ) existing between the primary reference element and  
15 the secondary reference element;
- 16 d) calculating means for calculating the remaining  
17 operating time ( $\Delta t_R$ ) of the measuring probe.

1           16. A method of monitoring or controlling a  
2 process, wherein the method comprises using the apparatus  
3 according to claim 15.